

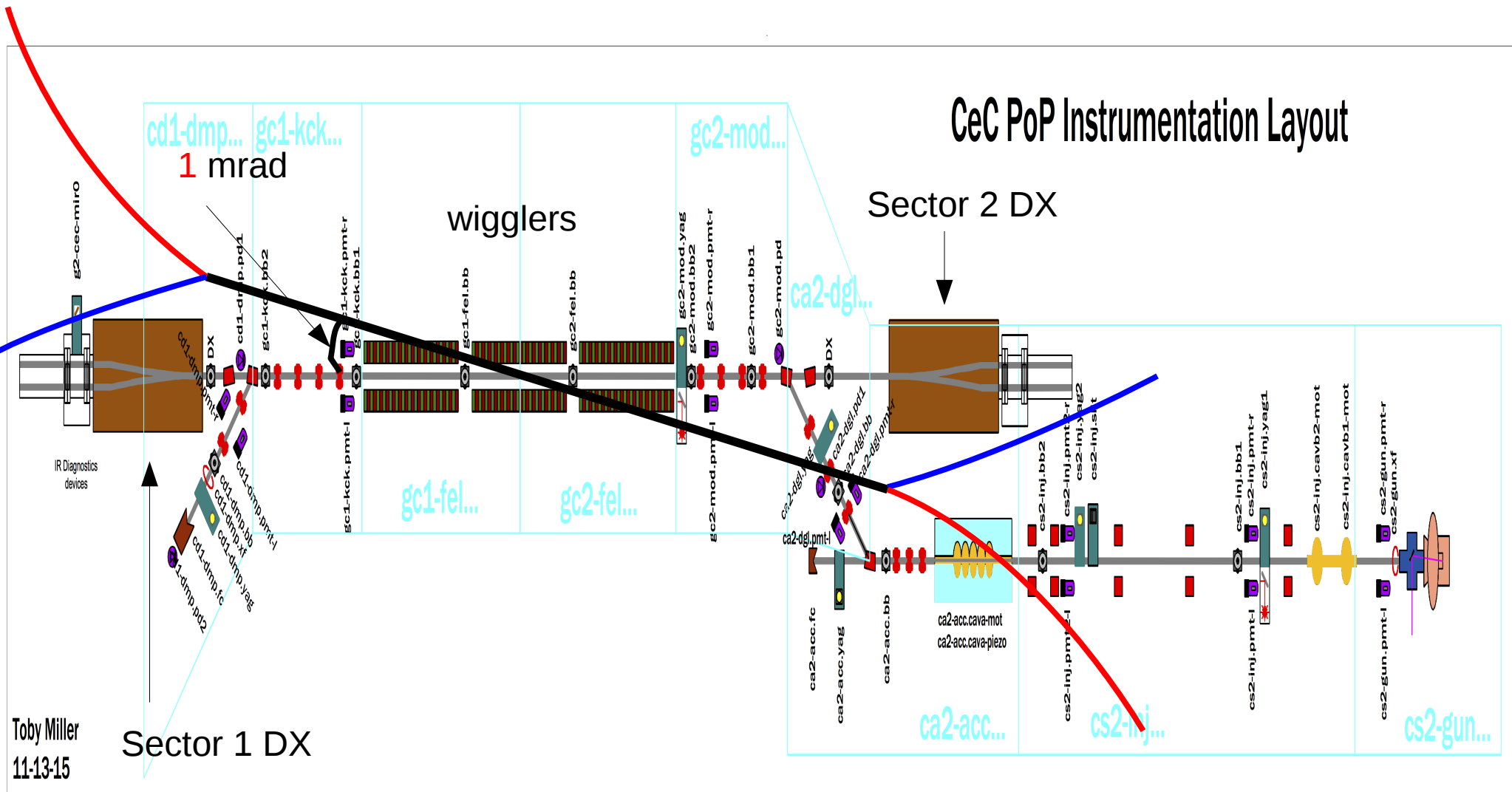
Can we run d-Au?

C. Liu

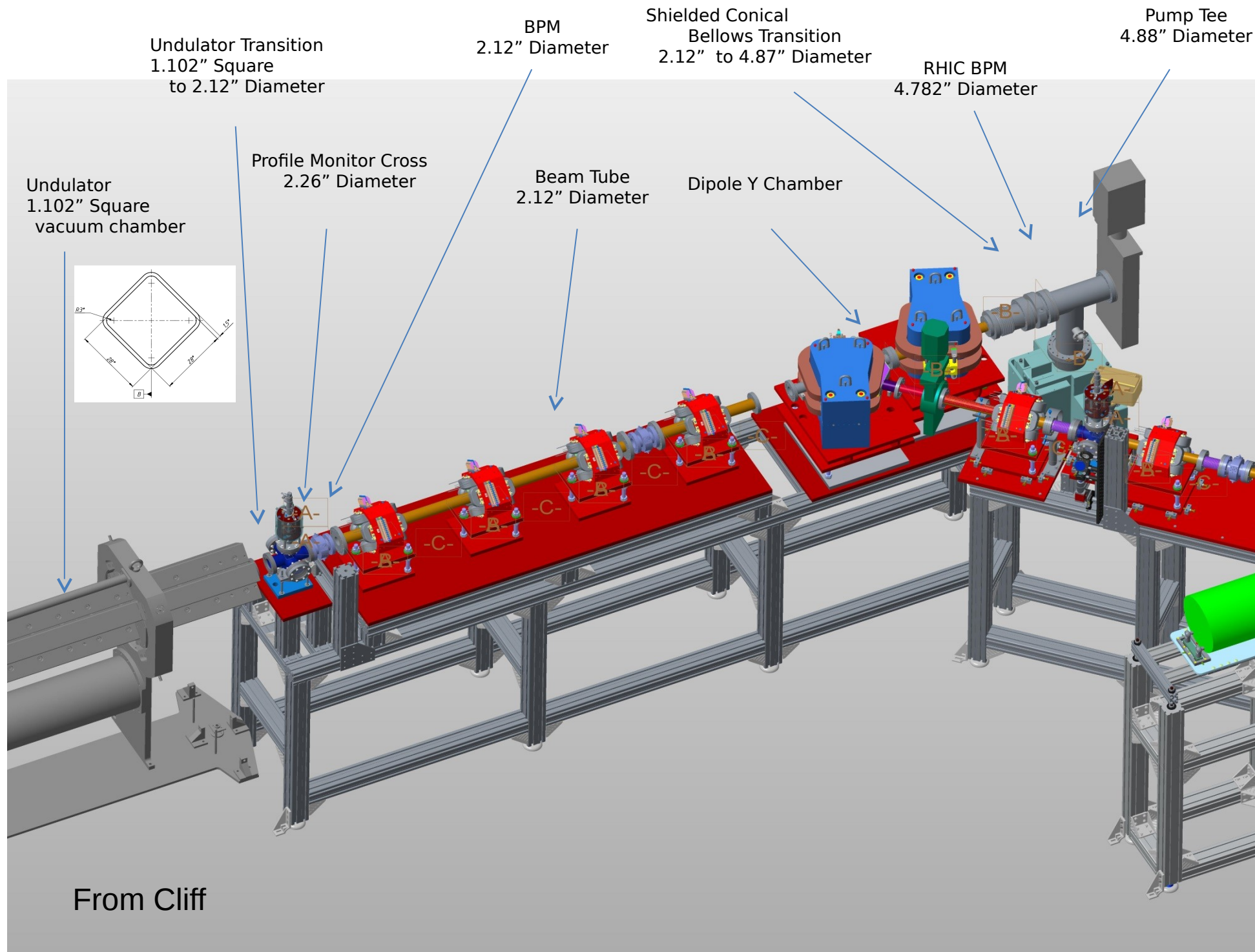
Feb. 23, 2016

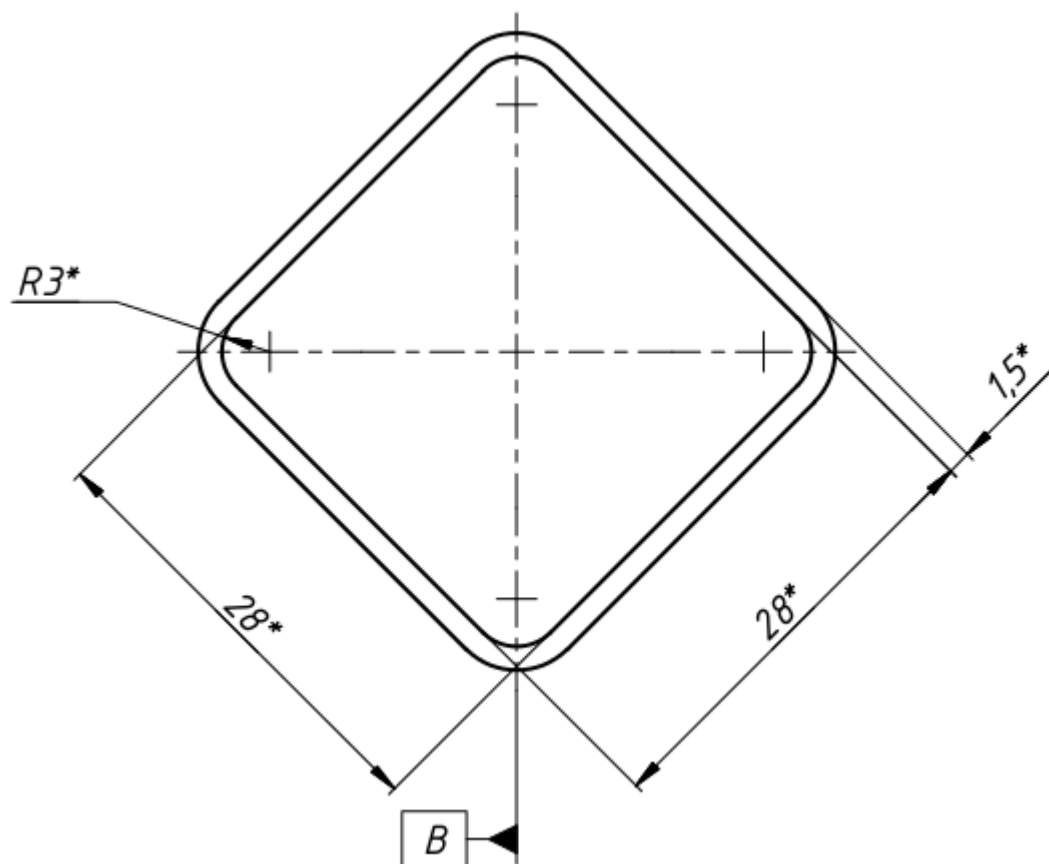
Experiments & Detectors meeting

CeC layout and d-Au orbits



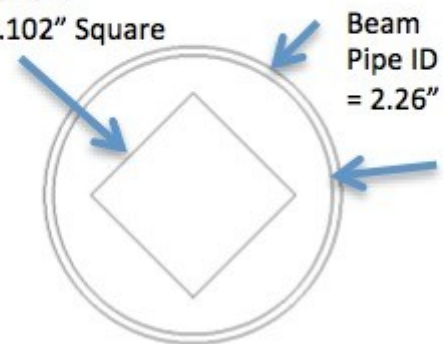
The blue line represents the blue beam, the red line represents the yellow beam, the black line shows the beams separated by 8 mm vertically only.





Aperture of Profile Monitor compared to undulator chamber

Undulator Aperture
= 1.102" Square



Beam Pipe ID
= 2.26"

Profile Monitor Shield Aperture
= 2.125"

Observations during AuAu setup

- Beam loss happened at IR2 when injection matching was bad. One needs to follow “injection setup instruction” to avoid excessive loss at IR2.
- Blue loss mostly at g2-lmx-und, Yellow loss at g1-lmx-und.

Aperture studies

- Position scan found obstacle in the lower, out part of the chamber when beam is at -5 mm vertically.
- Loose RF fingers were found with imaging by Vladimir and team. Vertical offsets ~ 4 mm was found by survey.
- Angle scan (beam at ± 4 mm) found asymmetry of the chamber. The suspicion is the chamber is with a horizontal offset ~ 1.0 mm. Confirmed by Igor's independent beam study with CeC quads.
- The maximum beam angle one can inject beam is 0.7 mrad.

Two solutions

- Realign CeC chamber for d-Au beam trajectories. Disadvantages: chance of breaking vacuum, need to align e beam with an angle, FEL not in the center of the IR mirror...
- Reduce d-Au beam angle to be <0.7 mrad. Disadvantages: beam offset center in final focusing quads, which is also potential limiting aperture, need study time.

Plan

- Reduce beam angle by employing beam offset and angle at D0 magnets.
- The ultimate goal of the study is to be able to inject to the designed orbit and cross transition.
- The test can be done only with the yellow beam.

Backup slides

Possible scenarios

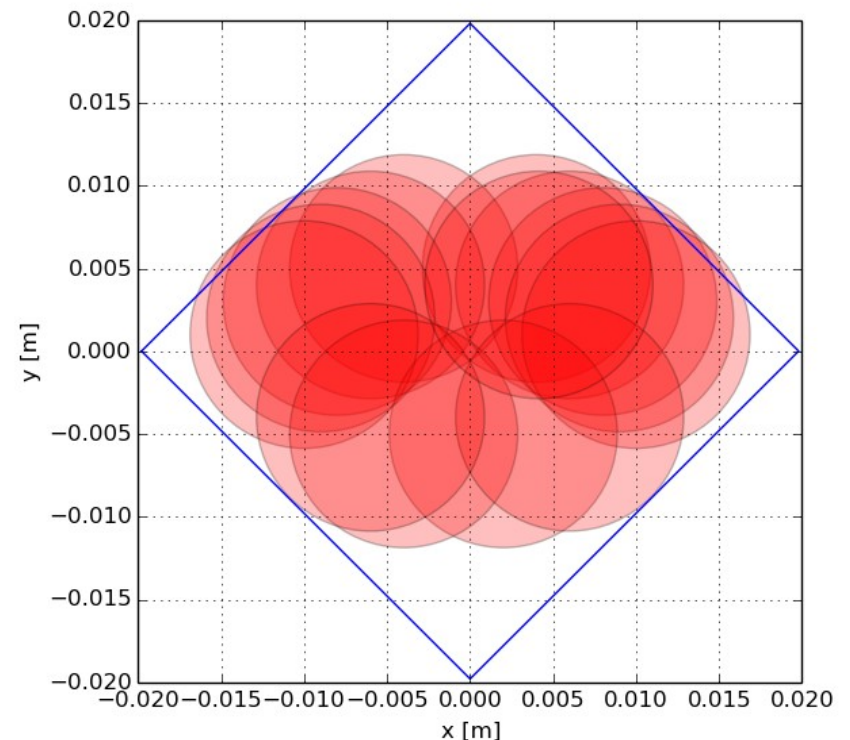
- Be able to reduce beam angle sufficiently. Then d-Au run doesn't have to count on realignment of CeC chamber.
- Only be able to reduce beam angle half way. Then I need to request fixing the horizontal offsets of the chamber.

Position bump scan

Vertical offset (mm)	Horizontal aperture (mm)
5	+/-4
4	+/-6
3	+/-8
2	+/-9
1	+/-10
-4	+/-6
-5	+2, -4

Done by Greg, Travis

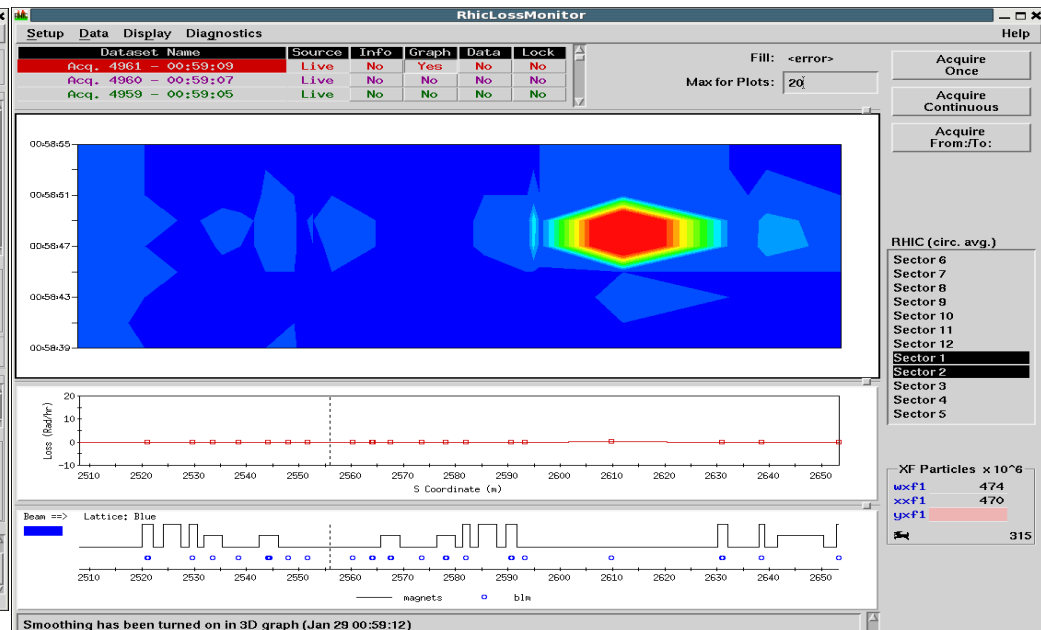
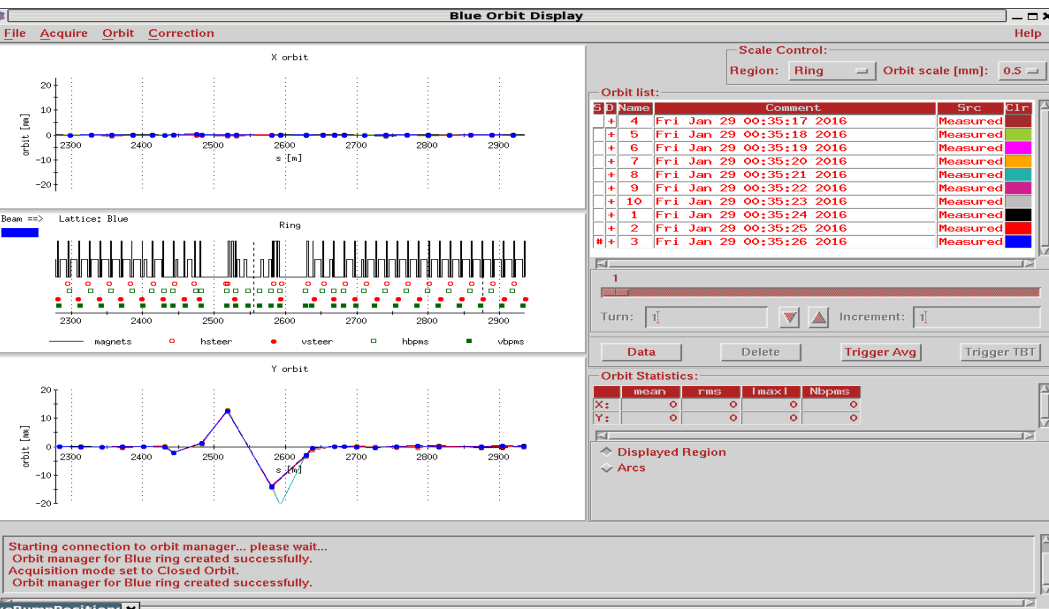
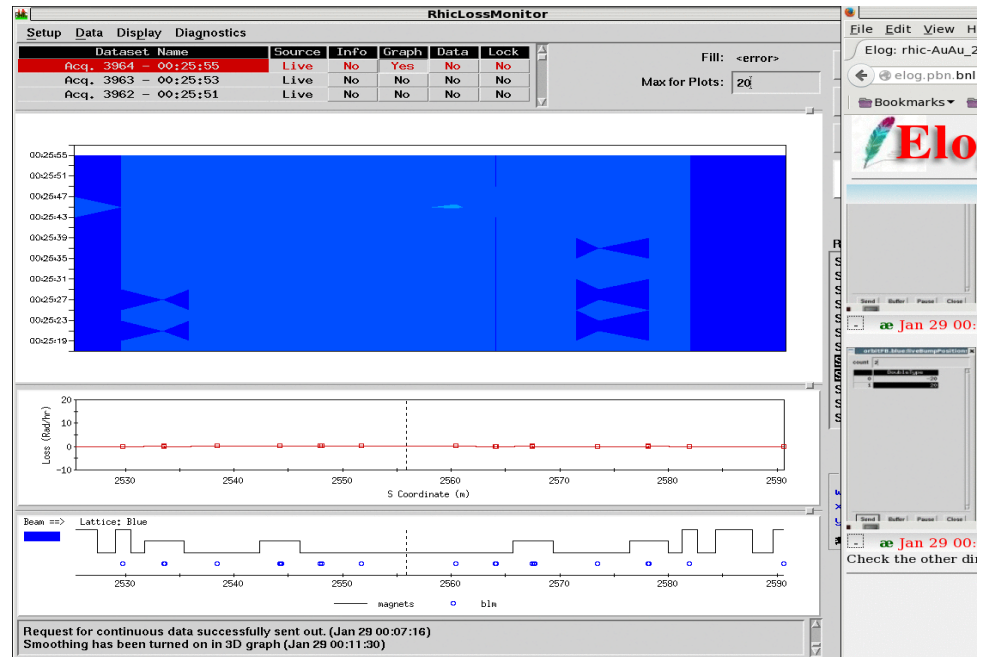
Obstacle is on the lower part and
outer side of the pipe.



Angle scan with correctors

- Blue beam was scanned horizontally with angle while at +4 and -4 mm vertical offsets on Jan. 29 owl shift. Beam angle was changed incrementally until local loss appeared on either g1-lmx-und or g2-lmx-und.
- Maximum horizontal angles were ± 0.68 mrad (based on beam position at Q1) when I saw loss on both ends, which translate to ± 3 mm at the far ends of undulators (discrepancy with position scan). The angle inferred from button BPM is $(+0.9, -0.85)$ mrad.
- Blue beam was scanned vertically with angle while at zero horizontal offset. The beam scraped between Q3 and Q4 (LEReC component?) before it can probe the apertures of CeC chambers.

Angle scan with correctors

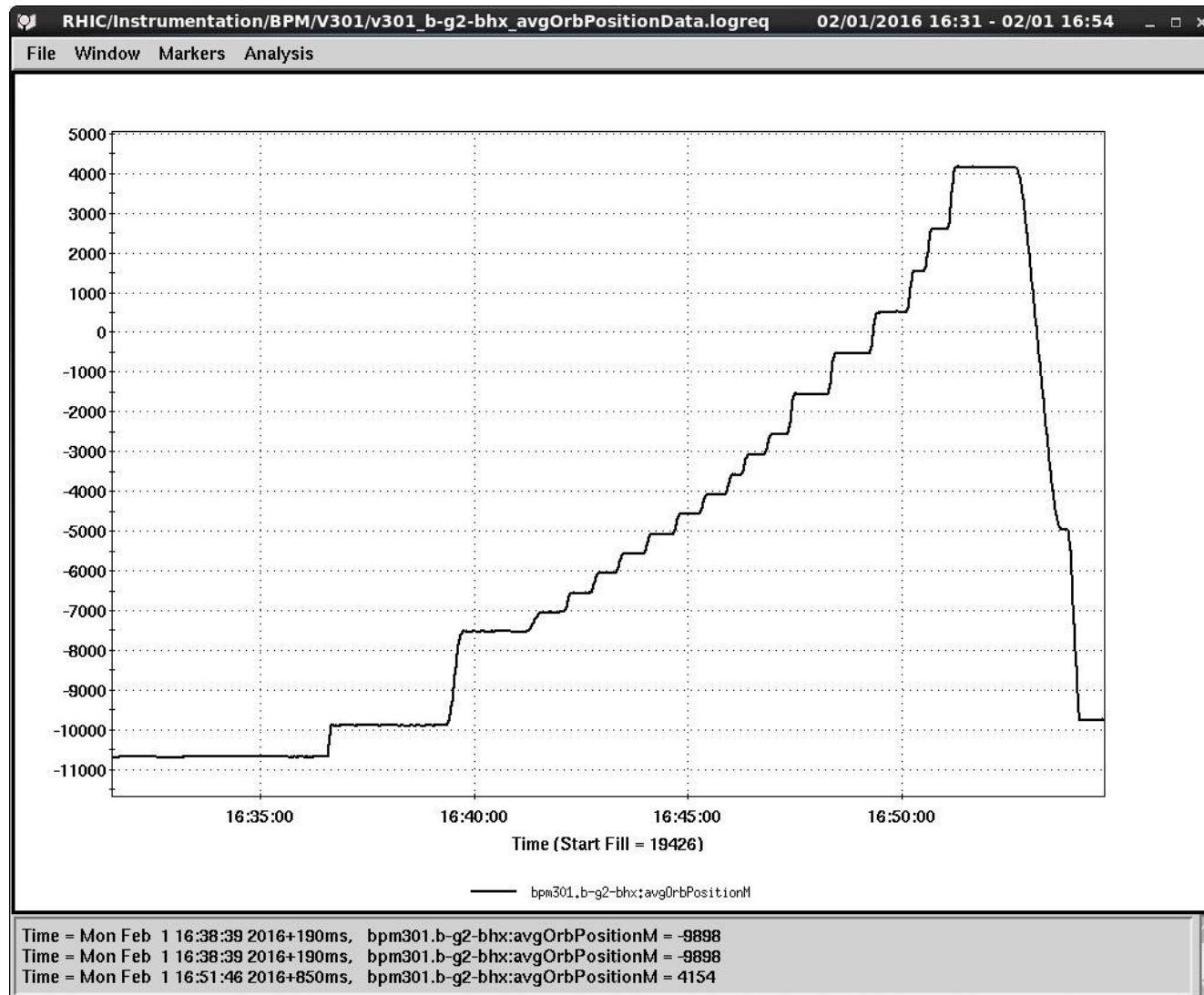


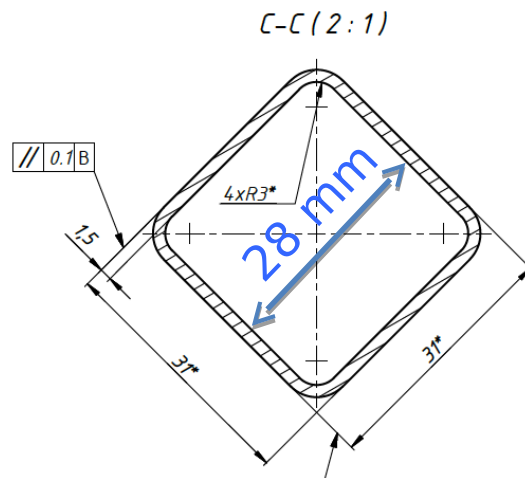
Angle scan with DX

- Blue beam was scanned while at 4 mm vertical offset, only to the opposite angle than that for dAu due to limit of D0 shunt.
- Only one horizontal button BPM was working at the time of the scan, with not perfect calibration factor. The alternative is to believe whatever angle was requested.
- The angles achieved were 1.4 mrad (requested) 1.6 mrad (based on button BPM), which translate to 6.0 and 6.8 mm at the ends of the undulators (agreement with position scan).

Angle scan with DX

Beam position reported by button BPM during the scan





The fingers are at 1:00 side. This is ~1.1 meters from the 02:00 IP. Fingers are on the upper quadrant on the inside of the ring.

- 5 RF fingers sticking out from top-inside the ring (note that observing through the horizontal 45° mirror flips left to right)
- Diamond vacuum chamber was surveyed to be higher by ~2.5mm.

Summary

- Aperture studies not yet give a complete picture of the IR2 aperture yet.
- Loose RF fingers were found by Igor through imaging. Diamond vacuum chamber elevated by ~ 2.5 mm.

Plans

- Continue with aperture study with beam. Focus on DX angle scan with Yellow beam at ± 4 mm vertical offset. Rob M working on button BPMs to assist the study.
- APEX study to reduce beam angle for dAu.
- The ultimate goal of the study is to Be able to inject to the designed orbit and cross transition.
- In parallel, it is planned to fix loose RF fingers and vertical survey offsets of the diamond chamber.